

## INTERNAL DOSIMETRY TECHNICAL BASIS DOCUMENT

This plan describes


- the potential for internal doses at Ames Laboratory, and
- the Ames Laboratory's Bioassay Contingency Plan

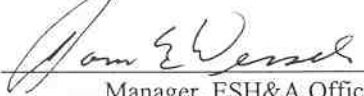
Comments and questions regarding this plan should be directed to the contact person listed below:

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### Sign-off Record:

Approved by:  Date: 4/10/2001  
ESH&A Office Health Physicist

Approved by:  Date: 4-10-01  
Manager, ESH&A Office

<b>Ames Laboratory</b>	<b>Plan:</b>	10202.001
<b>Office:</b> Environment, Safety, Health & Assurance	<b>Revision:</b>	2
<b>Title:</b> Internal Dosimetry Technical Basis Document	<b>Effective Date:</b>	04/10/01
<b>Page:</b> 2 of 6	<b>Review Date:</b>	04/10/04

## 1.0 Revision/Review Log

This document will be reviewed every three years as a minimum.

Revision Number	Effective Date	Contact Person	Pages Affected	Description of Revision
0	11/22/99	Hokel	All	Initial Issue
1	01/31/00	Hokel	All	Review
2	04/10/01	Simpson	All	Complete rewrite

## 2.0 Purpose and Scope

This plan provides information regarding the technical basis and rationale explaining the essential elements, supporting evidence and reference information of the Ames Laboratory internal dosimetry program. It includes a discussion of the process and requirements for obtaining bioassay services from a qualified organization and evaluating and recording the results of bioassays.

## 3.0 Introduction

Internal dosimetry efforts are generally designed to assure that workers are receiving adequate protection, as is the situation with external dosimetry. Although the purposes are much the same, perceptions about external and internal radiation doses and their associated risks are quite different. The main difference relates to the fact that internal radiation doses arise from the intake and deposition of radioactive material in the body. Also, the deposited radioactive material may be retained in the body, depending on its effective half-life, and the doses may be received over many years after an actual intake. The primary purpose for internal radiation assessments is to assure that workers are receiving adequate protection from internal radiation sources.

## 4.0 Prerequisite Action and Requirements

### Definitions

#### *Administrative Control Level (ACL):*

Individual dose limit specified by Ames Laboratory for the purpose of keeping doses to sources of radiation as low as reasonably achievable. Specifically, Ames Laboratory ACL is 500 mrem per year.

#### *Annual Limit on Intake (ALI):*

The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given

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<b>Title:</b> Internal Dosimetry Technical Basis Document	<b>Effective Date:</b>	04/10/01
<b>Page:</b> 3 of 6	<b>Review Date:</b>	04/10/04

radionuclide in a year by the reference man that would result in a committed effective dose equivalent (CEDE) of 5 rem or committed dose equivalent (CDE) of 50 rem to any individual organ or tissue.

***Derived Air Concentration (DAC):***

The airborne concentration that equals the ALI divided by the volume of air breathed by an average worker for a working year of 2000 hours (assuming a breathing volume of 2400m<sup>3</sup>).

***Dose of Record:***

The radiation dose recorded in the permanent dose file by the Health Physics Group.

***Exposure:***

The general condition of being subjected to ionizing radiation, such as by proximity to external radiation sources of ionizing radiation or through intake of radioactive material into the body. In this document, exposure does not refer to the radiological physics concept of charge liberated per unit mass of air.

## **5.0 Policy Statement**

The Department of Energy requirements for establishing and operating an internal dosimetry program are specified in 10 CFR 835, subpart E, paragraphs 402(c) and 402(d). The Ames Laboratory Radiation Protection Program (RPP) plan addresses these requirements via the following statement.

*“There are: (1) No radiological workers who, under typical conditions, are likely to receive a committed effective dose equivalent of 0.1 rem or more from all occupational radionuclide intakes in a year; (2) No declared pregnant workers likely to receive an intake or intakes resulting in a dose equivalent to the embryo/fetus in excess of 10 percent of the stated limit in § 835.206; (3) No occupationally exposed minors who are likely to receive a dose in excess of 50 percent of the applicable limit at § 835.207 from all radionuclide intakes in a year; and (4) No members of the public entering a controlled area who are likely to receive a dose in excess of 50 percent of the limits stated at § 835.208 from all radionuclide intakes in a year. Should the scope of activities be modified such that routine monitoring of individual exposures to internal radiation is necessary, Ames Laboratory will revise its internal dose evaluation program to ensure that the dose equivalent limits established in subpart C of this part are not exceeded. Ames Laboratory's internal dose evaluation program provides for discretionary monitoring on a case-by-case basis to address special circumstances and accidental or emergency exposures. Under these circumstances, bioassay and/or whole body counting services will be obtained from an accredited provider.”*

The Laboratory's internal dosimetry program is applicable only for individuals who have the potential for intakes of radioactive materials. The probability of a measurable intake of radioactive material and the potential for internal exposures at Ames Laboratory are extremely low and the types, quantities and frequency of dealing with radioactive materials do not support establishment and maintenance of a routine bioassay program at Ames Laboratory. Since small

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<b>Page:</b> 4 of 6	<b>Review Date:</b>	04/10/04

quantities of unsealed radioactive materials are handled infrequently and emergencies/accidents causing intakes corresponding to 100 mrem CEDE (committed effective dose equivalent) could happen, a contingency plan for obtaining bioassay measurements is maintained.

## 6.0 Procedure Performance

An internal dosimetry program generally consists of three elements: air monitoring, individual monitoring (direct or indirect radiobioassay and personal breathing zone BZ air monitoring) and dose evaluation of data collected. Ames Laboratory's program consists of:

- limited air monitoring,
- individual monitoring under special circumstances and accidental or emergency exposures as a contingency plan and
- dose evaluation of data collected.

The Laboratory's Integrated Safety Management System (ISMS) ensures that all activities are appropriately reviewed, hazards identified and controls implemented. ISMS mechanisms are utilized to identify the activities and individuals with potential for intakes of radioactive materials. These mechanisms include the Readiness Review process, Radiological Work Permits and authorization by the ALARA Committee. New activities or modifications to existing activities involving the use of sources of radioactive materials must be approved through the Readiness Review process. Special projects, such as mitigation of contaminated equipment or areas, are performed under guidance of a Radiological Work Permit issued by the ESH&A Health Physics Group. In addition, the ALARA committee must specifically authorize each activity that involves the use of radioactive material. These ISMS mechanisms ensure the identification of the potential for internal radiation exposure. Exposure to internal radioactivity is minimized by appropriate control mechanisms.

Activities presently approved at Ames Laboratory involve both sealed source materials and unsealed (open form) materials. The level of radioactivity, the form and quantity of unsealed materials involved, and the infrequency and short duration of performance of Ames Laboratory activities involving radioactive materials minimizes the potential for intake of radioactive materials. Laboratory activities may include: crystal growth involving small quantities of source materials, analytical and measurements activities involving samples and standards with low levels of radioactivity and neutralization and stabilization of liquid transuranic standards. These activities do not have the potential to produce airborne contamination that would create conditions resulting in internal doses exceeding 100 mrem CEDE.

Another infrequent, short duration type of action performed at Ames Laboratory consists of remodeling, remediation and maintenance in interstitial and utility spaces that involve residual historical uranium and thorium contamination. Workers who engage in such actions are provided an adequate degree of protection by the various engineering and administrative controls. Workers are equipped with appropriate personal protective equipment. When airborne

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<b>Title:</b> Internal Dosimetry Technical Basis Document	<b>Effective Date:</b>	04/10/01
<b>Page:</b> 5 of 6	<b>Review Date:</b>	04/10/04

radioactivity is suspected, trained workers are outfitted with activated carbon filtered respirators and protective clothing and the work is performed under the direction of a Radiological Work Permit, within the approval of a reviewed activity.

Current Ames Laboratory activities, under normal operating conditions, do not have the potential to result in internal radiation exposure at levels noted by 10 CFR 835.402. Therefore, it would not be cost effective and Ames Laboratory does not maintain an internal dosimetry program including routine bioassay capability. Ames Laboratory's internal dose evaluation program provides for discretionary monitoring on a case-by-case basis to address special circumstances and accidental or emergency exposures. Under these circumstances, bioassay and/or whole body counting services will be obtained from an accredited provider.

## **6.1 Limited Air Monitoring**

Little or no airborne radioactivity is produced at Ames Laboratory. No activities normally produce airborne radioactivity at a level that would constitute a need for bioassay monitoring. Therefore it is highly unlikely that an individual could receive an exposure of 40 or more DAC-hours in a year. The potential for airborne radioactivity is identified through various ISMS mechanism as described above. Administrative and engineering control mechanisms are implemented to minimize the likelihood of airborne radioactive materials being encountered by workers. Control mechanisms include respiratory protective devices and facility ventilation systems.

Air monitoring and sampling is performed as necessary to detect and evaluate the level or concentration of airborne radioactive material at work locations to assure that the individuals have not encountered significant airborne radioactivity. Such efforts also verify the integrity and effectiveness of administrative and engineering control mechanism. Due to the fact that no significant airborne radiation is produced during current normal operations, real-time air monitoring is not presently required. Real-time air monitors are available in the instrument inventory.

## **6.2 Individual Monitoring**

Individual internal exposure monitoring efforts are not routinely performed at Ames Laboratory. The Laboratory maintains a contingency plan for bioassay services on a case-by-case basis to address special circumstances and accidental or emergency exposures. Personal breathing zone (BZ) air monitoring is performed as needed to assess the need for further air monitoring and/or analysis.

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<b>Page:</b> 6 of 6	<b>Review Date:</b>	04/10/04

## **Contingency Plan for Bioassay Services**

In addition, the Plan provides for workplace monitoring and periodic review of operations involving radioactive materials to ensure that intake probability of internal dose remains low.

Ames Laboratory is not required to have DOELAP accreditation, since it has been given an exception from EH-352, which is on file. Accreditation in accordance with the DOE Laboratory Accreditation Program for Radiobioassay is also not applicable, since Ames Laboratory does not conduct a bioassay program, but rather relies on a Memorandum Purchase Order (MPO) with Argonne National Laboratory for bioassay services on a contingency basis (see attached). Argonne National Laboratory maintains a DOE approved Bioassay program.

Should the need arise to perform a bioassay on an Ames Laboratory employee, collection of bioassay samples would be performed under the joint responsibility of the Ames Laboratory Occupational Medicine Department and the Health Physics Group of the Environment, Safety, Health and Assurance Office. Sample collection protocols will be reviewed with Argonne National Laboratory.

The results would be the basis of a dose assessment using the ICRP Publication 30 model(s) and subsequent revisions of this document. The dose assessment would then be incorporated into the exposed individual's personnel exposure history.

### **6.3 Dose Evaluation of Data Collected**

The results of monitoring efforts will be the basis of an internal dose assessment. The dose assessment would then be incorporated into the exposed individual's personnel exposure history.

## **7 Records**

Appropriate records of internal doses and related information are required by 10 CFR 835. Such records are maintained according to Ames Laboratory record keeping procedures.


## **8 References**

10 CFR 835  
DOE G 441.1-3, Internal Dosimetry Program Guide  
Procedure # 10202.021 "Workplace Air Monitoring"

## **9 Attachments**

Memorandum Purchase Order (MPO) with Argonne National Laboratory

# Memorandum Purchase Order (MPO) with Argonne National Laboratory

 <h2>Purchase Order</h2> <p>The Ames Laboratory is operated by Iowa State University of Science and Technology in Ames, Iowa under Government Contract No. W-7405-eng-82.</p>			Purchase Order No. A1-1233 <small>This order number must appear on all packages, bills, invoices, etc.</small>			
<b>AMES LABORATORY</b> Vendor # 07515 630-252-7030			P.O. Date: 02/09/01 J:JLK Quotation Date:			
V E N D O R	ARGONNE NATIONAL LABORATORY OCF-PRO. BLDG. 201, RM. 2L25 9800 SOUTH CASS AVENUE ARGONNE, IL 60439 ATTN: WILLIAM WALSH		Terms: NET 30 F.O.B.: DEST. Ship Via:			
	Item	Quantity	Unit	Description	\$ Unit Price	\$ Total
	1	1	EACH	<p>THIS DOCUMENT IS NOT A CONTRACT. IT IS A MEMORANDUM PURCHASE ORDER ISSUED FOR SERVICES, EQUIPMENT OR MATERIALS UNDER GOVERNMENT CONTRACT W-31109-ENG-38 WHICH ARE NECESSARY AND REQUIRED IN CONNECTION WITH GOVERNMENT CONTRACT W-7405-ENG-82. THE TERMS AND CONDITIONS OF THE VENDOR'S PRIME CONTRACT WITH DOE SHALL APPLY. ACCOUNTING FOR COSTS OF MATERIALS, EQUIPMENT OR SERVICES BELOW WILL BE MADE IN ACCORDANCE WITH AND AS REQUIRED BY DOE CASH TRANSFER POLICY, DOE ACCOUNTING PRACTICES AND PROCEDURES HANDBOOK, UNLESS OTHERWISE DIRECTED BY DOE.</p> <p>THIS MEMORANDUM PURCHASE ORDER IS WRITTEN TO PROVIDE TECHNICAL SERVICES TO AMES LABORATORY. THESE SERVICES CONSIST OF RADIO-CHEMICAL ANALYSIS OF URINE AND FECAL SAMPLES AND WHOLE BODY COUNTING.</p> <p>IF AT ANY TIME THE SUBCONTRACTOR HAS REASON TO BELIEVE THAT THE TOTAL COST TO THE</p> <p>CONTRACTOR WILL BE GREATER THAN THE CEILING AMOUNT SHOWN ON THIS PURCHASE ORDER, THE SUBCONTRACTOR SHALL NOTIFY THE CONTRACTOR IN WRITING TO THAT EFFECT, GIVING THE REVISED ESTIMATE OF SUCH TOTAL COST FOR PERFORMANCE OF THE PURCHASE ORDER.</p> <p>PAGE CONTINUED</p>	16,000.00	16,000.00
	JACK CUMMINGS				Purchase Order Total	516,000.00
Requestor WESSELS THOMAS E G40 TASF Project Leader		Address HAUGEN/HARMON Approved By		75318 Emp. No. 81812 516000.00 10 780 408176 99 11 31080000 999999 Contract		
<b>Group Leader Copy</b>						

**Memorandum Purchase Order (MPO) with Argonne National Laboratory**  
(continued)

Continuation of Purchase Order					Purchase Order	
The Ames Laboratory is operated by Iowa State University of Science and Technology in Ames, Iowa under Government Contract No. W-7406-eng-82.					No. A1-1233	
Page <u>2</u>					This order number must appear on all packages, invoices, etc.	
Item	Quantity	Unit	Description	\$ Unit Price	\$ Total	
			UNLESS TERMINATED EARLIER, THIS MEMORANDUM PURCHASE ORDER SHALL EXPIRE ON SEPTEMBER 30, 2006.  Delivery of all items should be as soon as possible or by your indicated date of - 09/30/06.  FINAL PAGE			

Group Leader Copy